

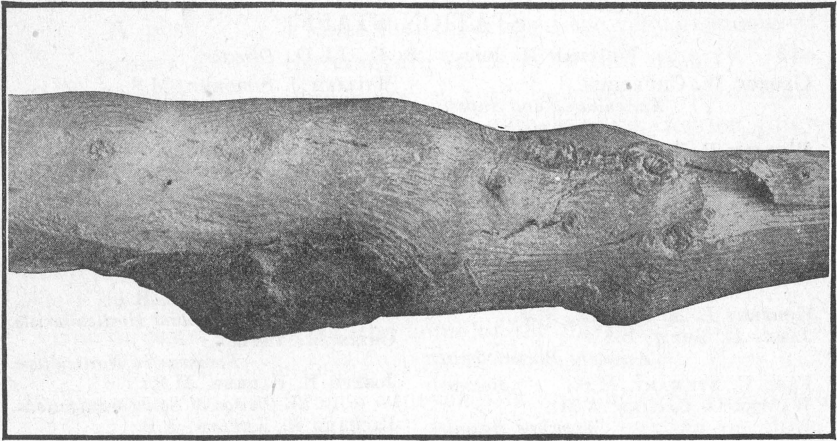
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A GOOD UNION

NEW YORK GRAPES ON NEW ROOTS

SUMMARIZED BY

F. H. HALL

FROM BULLETIN BY

U. P. HEDRICK

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*Riverhead, N. Y. †Absent on leave. ‡Connected with the Chautauqua Grape Work.

POPULAR EDITION*

OF

BULLETIN No. 355.

NEW YORK GRAPES ON NEW ROOTS.

F. H. HALL.

**A pest
proves a
benefit.**

About 1860 an insect was introduced into France that threatened the very existence of the vineyard industry in that country. The phylloxera, a tiny root-feeding plant-louse from America found the thick, tender, juicy roots of the European wine grape just to its liking and French climatic conditions exactly suited to its rapid increase. In a few years, its wide-spreading devastations caused a feeling almost of terror among vineyardists; for insecticides proved powerless to check its destructive advance.

But in eastern America, the home of the phylloxera, the insect does little harm to the many native species of grapes. Here was a suggestion; so the French vineyardists brought over American stocks to furnish phylloxera-resistant roots and grafted on these plants cions of their favorite varieties. The phylloxera found the tough, dry, woody roots of American species, particularly those of the riverside, or winter, grape, as little to their liking in France as in America and the vineyards were saved. More than this! The European varieties on the new roots often gave better grapes than ever before. Some kinds that would grow only poorly, except on certain soils or in favored localities, proved much more tractable on the roots of some American species; other kinds were

* This is a brief review of Bulletin No. 355 of this Station on Grape Stocks for American Grapes by U. P. Hedrick. Anyone interested in the details of the investigation will be furnished, on application, with a copy of the complete bulletin. The names of those who so request will be placed on our Station mailing list to receive future bulletins issued, popular or complete edition as desired. Bulletins are published at irregular intervals, not monthly.

changed in season of ripening that they reached better markets; and, in other ways, perhaps less important, grafting of varieties on new roots worked to the advantage of the grape-growers. The advent of the phylloxera really widened the possibilities of the European grape. In California, where the European grape (*Vitis vinifera*) is grown, as well as in France, grape-grafting has been studied and practiced with zeal and has undoubtedly aided greatly in the development of the wine, raisin and dessert-grape branches of that State's horticulture.

**Grafting useful
abroad, why
not in
New York?**

While the phylloxera is not a dreaded pest in America east of the Rockies, and root-grafting is not here essential to the existence of vineyards, has not this process possibilities in eastern grape-growing? Some of our very best eastern grapes are commercially of little value because of defects which grafting has partially or wholly removed in case of other varieties in France and California; why is there not promise that similar results will follow if the combinations of root and cion are studied as carefully for our varieties and our conditions?

Varieties developed from our native species are exceedingly diverse as to soil requirements. Those derived from *Vitis rupestris*, the sand grape, or rock grape, thrive well on hard, dry soils; those from *Vitis æstivalis*, the summer grape, bunch grape, or blue grape, do well on light, thin soils. Descendants of the fox grape, *Vitis labrusca*, prefer loose, hard, sandy or gravelly soils, while those varieties whose parent species delight in the warm, moist, river banks (*Vitis riparia*) do best in the vineyard on rather heavier soils than those preferred by other grapes. In response to heat or cold, shade or sunshine, moisture or drought, in susceptibility to insect and fungus diseases, in productivity, in longevity and in size of vine, these different species show great variations; and in the vineyard, propagation, cultivation and spraying must be modified to suit the varied types. It seems entirely logical to suppose that the chances of betterment through grafting upon one of these diverse types of root stocks some of our

cultivated varieties (which are derived from eight or nine distinct species) are as great, if not greater, than in grafting the Vinifera varieties upon these stocks in France.

**Vineyard
experiment
located.**

Hope that this might be true inspired an experiment along this line by the station. Work was begun upon this vineyard in 1902 and since 1908 many of the vines have given crops so that it seems time to report progress. In its development as an experiment, however, the vineyard has been practically a failure; since the vines have had many more than their fair share of mishaps and calamities. But in spite of untoward happenings that make the actual data secured scanty and irregular, the general behavior of the vines has been such that growing American grapes on roots other than their own must be considered a promising method of vineyard improvement, at least for the growth of choice varieties and possibly for the commercial vineyard.

This experimental vineyard was located in the Chautauqua Grape Belt on the farm of Mr. I. A. Wilcox of Portland, Chautauqua county. The experimental plats were located on two soils; one plat on Dunkirk gravel contains about an acre on which were set six hundred vines, and the other plat on Dunkirk clay contains about two-fifths of an acre, on which were set two hundred and twenty-five vines. In the smaller vineyard, only three groups of root stocks were used and in the larger vineyard, four groups. In successive rows were set stocks on their own roots, on roots of St. George (*Rupestis du Lot*), on *Riparia Gloire de Montpellier* and on *Clevener*.

**Characteristics
of
root-stocks.**

The St. George was selected as a variety pre-eminently well adapted to sandy, gravelly, rocky soils. It has strong roots which force themselves deeply into even very compact soils and enable it to withstand droughts. It is very vigorous in growth and communicates its strength to its grafts. It roots rapidly in the nursery and unites well when grafted with either *Vinifera* varieties or American species. In New York it was found to sucker very freely, the

principal defect of the stock. The Riparia Gloire, as it is called for short, has small, hard, numerous, much-branched roots, which feed close to the surface of the ground. It grows best in deep, rich soils which must not be either too wet or too dry. Like St. George, it is vigorous, imparts its vigor to vines worked upon it, and is also specially hardy. It is well adapted for grafting purposes, as it unites readily with our cultivated varieties. Its principal defect is some fastidiousness as to soils. The Clevenor stock was selected since it grows on a wide range of soils. It has already been used to some extent as a root-stock in this State. The Riparia Gloire and St. George stocks came from California and were in very poor shape on arrival. They were set in May, 1902, and by the fall of that year, one-fifth of the St. George plants and five-sixths of the Riparia Gloire vines had died, but the vacancies were filled with new stocks of the same varieties. These replanted vines were taken from nursery rows where they had been set after bench-grafting the cions on closely-trimmed root stocks. The Clevenor stocks were not set until the spring of 1903. The field grafting upon all these stocks was begun in May, 1903, which was probably not the best time; as subsequent experience has proven that the union is best if the grafting is done when the stock is not in full sap.

**Varieties
used.**

As varieties to be grafted upon these stocks, about twenty kinds of exceptionally good quality were selected, practically all of which had already been grown more or less in the Chautauqua Grape Belt. These varieties, with a brief indication of the reason for their choice, are as follows: Agawam, Barry, Brilliant, Lindley, Mills, and Niagara were selected as varieties which, though admirable in most other respects, are hardly productive enough to be commercially profitable; and in France and in California grafting on other roots has often increased productivity. In other instances, grafting has enabled certain varieties to be grown on soils seemingly not adapted to them and since Campbell Early, Delaware, Herbert, Iona, Lindley, and Worden succeed only when soil con-

ditions are right, it was hoped to find in some of the new root stocks a medium to increase the range of cultivation of these varieties. If Brilliant, Goff, Vergennes and Winchell could be improved in bunch characteristics, they might become very valuable sorts and grafting has sometimes worked such improvement, so these varieties were included. Jefferson and Niagara are not always hardy under New York conditions and if their growth on other stocks could make them more resistant to cold it would improve their standing as commercial varieties. Delaware was used in the hope that its slow rate of growth might be overcome. Catawba, grown on its own roots, is a little too late to succeed in most seasons in New York, and Brighton deteriorates rapidly after picking. If these qualities could be remedied by grafting, most desirable results would be secured.

**Progress
of the
experiment.**

The failure of vines during the first year was an inauspicious beginning and similar misfortunes followed the experiment throughout its progress. During the second year, 1903, seventeen more Riparia Gloire stocks died, nine of St. George, nine of Clevener, and twenty-nine on their own roots, while of the grafts, eight on the Gloire died and forty-eight on the St. George but none on Clevener. During the winter of 1903-04, the weather was very severe and in the spring and summer of the following season many more vines died; of St. George, eighty-five; of Gloire, fifty-six, and of those on their own roots, forty-eight. The effects of this severe winter were remedied as far as possible by setting in new vines, but the consequences of the freeze plainly extended through several subsequent seasons as many of the vines lagged in growth and never reached their normal vigor. As a commercial venture and, as later events proved, as an experimental one, it would have been better to dig the vines up in 1904 and to begin anew. The freeze, however, gives some indication of the relative hardiness of the vines of these varieties on different stocks; as only 36½ per ct. died on St. George roots, while over 44 per ct. were lost on Clevener and about 40 per ct. on Gloire or on their own roots. It is possible that the deep-rooting habit of the St. George stock

enabled it to resist this cold weather a little better than the other stocks.

During 1906 the grape *fidia*, which had appeared in the vineyard a few years previous, began to affect some of the vines severely and this injury continued to some extent throughout the remaining years of the experiment, although repressive measures were fairly successful in controlling the insect. In 1906, additional vines died; on Gloire stock thirty-four, on St. George twenty-seven, on Clevener thirty-five, and on their own roots nine. These dead vines were, in many cases, weaklings injured by the severe weather of the two winters past. In 1907, the vines appeared to be making good growth and there were fair prospects for a good harvest of grapes, but in August a hailstorm ruined the crop so that the fruit was never picked; and again in 1910 the crop was entirely destroyed by hail.

Grafted vines more productive.	The death of so many vines during early stages of the experiment, severe attacks of <i>fidia</i> during one or two seasons, and the two disastrous hailstorms have made it impossible to secure any satisfactory amount of
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data upon which to base definite conclusions regarding productivity of the individual varieties. Yet throughout the whole course of the work, observations have shown that grafted vines were fruiting better than vines of the same varieties on their own roots. Not only were more bunches set upon the grafted vines, as shown by actual count, but the bunches and the berries also grew larger, resulting in less unmarketable fruit. Such data as were secured from three fairly satisfactory harvests—those of 1908–09–11—give evidence in the same direction. Computations, based on the actual weight of fruit harvested from each vine, would give an average acre yield of $2\frac{1}{4}$ tons of grapes from varieties on their own roots, 3 tons from those on St. George stock, 3.4 tons from those on the Gloire stock and 3.6 tons from those on Clevener roots. These yields are, of course, small, and perhaps ought not to give any great weight to an experiment which has lasted through eleven years. In reality, during this time only one satisfactory harvest was secured, that of the year 1911; and the figures for

this year alone correspond very closely to the judgment of the observers from general behavior of the vines and might be taken as an index of the trend of the experiment. They point in the same direction as the figures from the averages of the three crops. The yields in this year were, for varieties on their own roots 4.4 tons per acre, on St. George roots 5.4 tons, on Gloire 5.3 tons, and on Clevenor 5.6 tons. The data are too few and scattering to attempt comparisons variety by variety either in productivity, resistance to insects or diseases, or except in a general way in adaptability of cions to stocks.

**Grafted vines
more
vigorous.**

However, it was very plain to those who studied the vineyard that the grafted vines were more vigorous than those not grafted. In an attempt to bring out this point, the vigor of vines was carefully rated in one season. Early in 1910, when the vineyard had reached bearing age, when insects and fungi were well under control and before the hailstorm of that year ruined the crop, careful estimates gave varieties on their own roots an average rating of 40 per ct. of perfect vigor, those on St. George 63.2 per ct., those on Gloire 65.2 and those on Clevenor 67.9 per ct. As already stated, it would be unfair to make strict varietal comparisons in this regard, but the better behavior of nearly all the varieties on all three of the stocks proves these stocks congenial for union with our varieties and speaks in favor of their use in future work along this line. No variety on its own roots reached an average of 70 per ct. of what might be expected, but on Gloire roots, Concord, Herbert, and Lindley reached averages of more than 75 per ct.; on St. George roots, Concord, Herbert, Niagara, and Vergennes all exceeded this average; while on Clevenor roots Barry, Brighton, Catawba, Delaware, Lindley, Regal, and Vergennes proved far better than on their own roots.

**Resistance to
insects and
diseases.**

While one of the principal objects of the experiment was to test the effect of grafting upon resistance to insects and diseases, the work has really furnished no satisfactory evidence along these lines. The mishaps during the early years of the test made so unequal the numbers of

vines of the same age among the different varieties that it is practically impossible to secure a fair estimate as to the relative damage of insects or diseases upon either roots or vines. When the earlier experiments proved that this vineyard was not likely to be an unqualified success a similar experiment was started elsewhere, it is hoped under more favorable conditions. From this second test it is expected that at least some suggestions of value along the line of insect resistance will be secured.

**Some
grafted
grapes
earlier.**

Some grapes on grafted vines ripened a few days earlier than those on their own roots. This was true, in particular, as regards those on Gloire and Clevenner; but it is not certain that there is a constant difference in the time of ripening between the same varieties on St. George roots and on their own. In fact, some varieties on St. George were retarded in time of maturity. The data relating to time of ripening, however, are not satisfactory, like others in the test; but it is hoped that the second experiment will furnish more definite information.

Conclusions.

Unsatisfactory as it has been, this experiment seems to promise quite a little of value in grape-grafting for New York State. Undoubtedly some of the best varieties of table grapes suitable to the Chautauqua Grape Belt can be improved in some respects by grafting and it is not entirely improbable that even commercial vineyards will show a sufficient increase in productiveness to warrant the adoption of the practice in starting new vineyards. If the method is adopted, however, some of the mistakes in this experiment should be avoided. In the first place, it would have been much better to use bench-grafted vines instead of grafting in the field on growing stocks, as a very large proportion of the plants thus treated died in this experiment; and a considerable portion might do so in any commercial planting. Such vacancies must be filled by bench-grafted material. Bench-grafting in itself gives better results, is much more easily performed and can be kept under closer supervision of an expert than can work done in the

field. If all the vines were bench-grafted originally and grown in the nursery row for a year, careful selection could be made of perfect, vigorous plants, with unions well established, to be set in places where desired with the unions placed at the desired level in the soil and the plants free from undesired suckers from the root stocks or roots from the cions. By this method subsequent vine failures should be very few under ordinarily good conditions. By this means, also, the vineyard area can be held for one year longer for other crops, or for better preparation for vineyard purposes.

In selecting stocks for such work, it is believed that the three used in this experiment should all be given a trial though it may be rather difficult to secure the Cleveners stocks necessary, while the St. George and Riparia Gloire stocks can be readily secured from California growers. To these stocks might well be added *Riparis Grand Glabre* and two hybrids between *Vitis riparia* and *Vitis rupestris*, known as 3306 and 3309, which have been found useful in California viticulture.

If a grafted vineyard is established, it will be necessary to give better care to it than the ordinary vineyard receives, in pruning particularly, but to some extent in plowing, tilling, fertilizing and treatment of phylloxera and fidia. The varieties on other roots will require different treatment from the same ones ungrafted. This is by no means a disadvantage, for, probably, of all our horticulturists the vineyardists have become least caretaking. If the grafting in itself did not promise larger yields, its adoption would be of profitable benefit to New York viticulture if it secured to the new vineyards the care grape-growing should receive.

The first part of the paper is devoted to a discussion of the general principles of the theory of the structure of the atom. It is shown that the structure of the atom is determined by the laws of quantum mechanics, and that the laws of quantum mechanics are determined by the laws of the theory of the structure of the atom. This is a circular argument, but it is the only way to proceed.

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